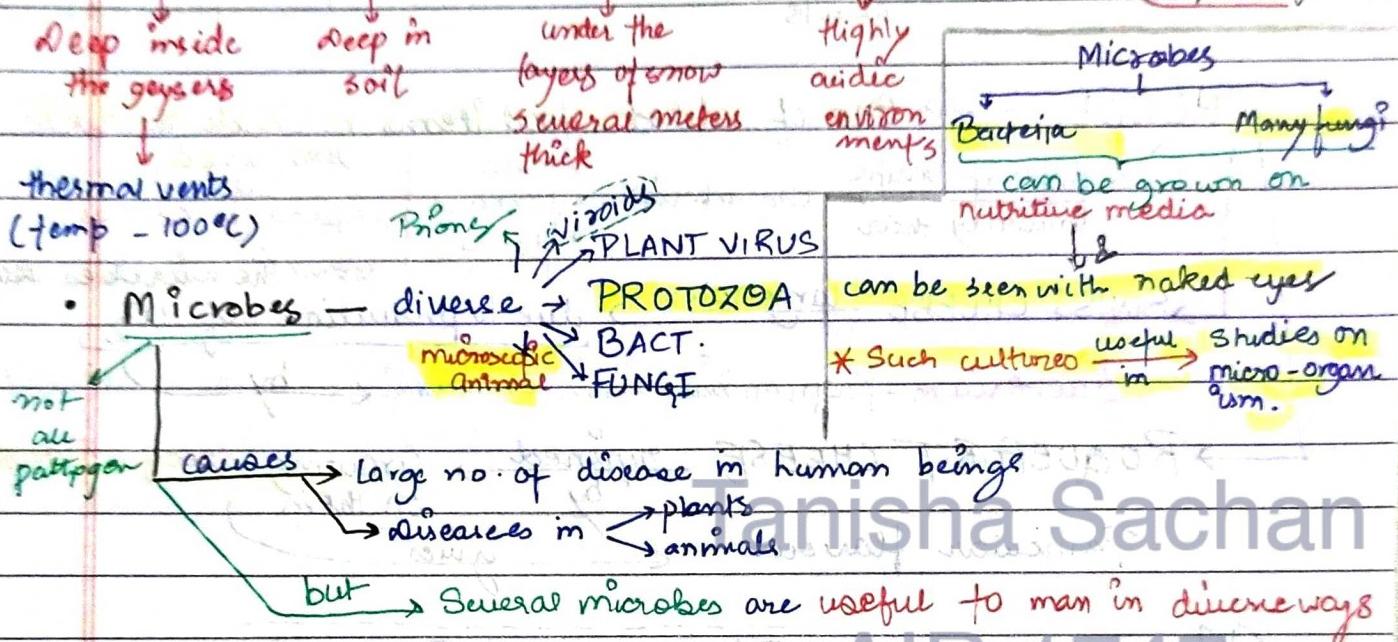
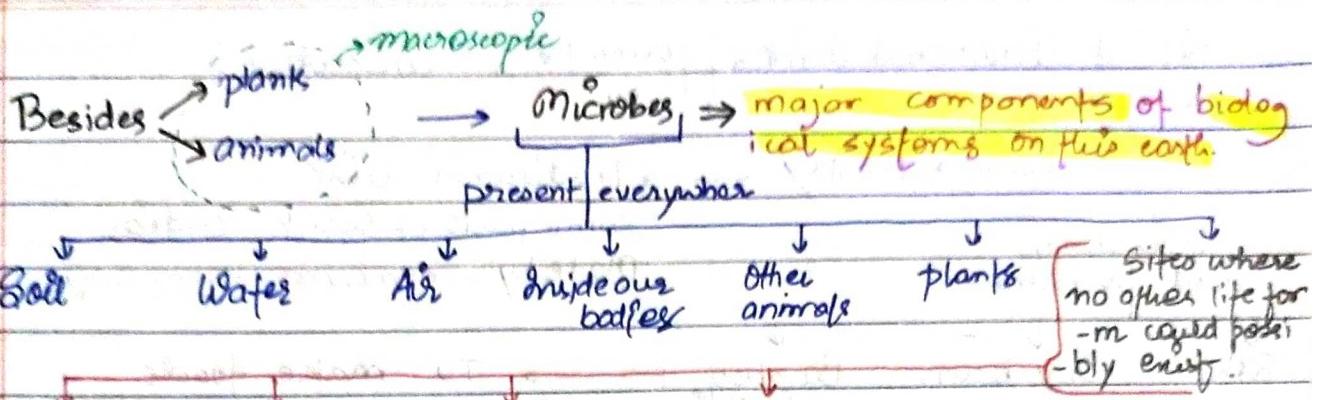


MICROBES in Human WELFARE



MICROBES IN HOUSEHOLD PRODUCTS

We use products derived from microbes — everyday.

Eg. → Milk ① LAB (Lactic Acid Bact.) → Curd ← forms
② Lactobacillus When they grow → Produce acids that coagulate & partially digest milk proteins.

contain millions of LAB Small amt. of curd as muculum OR Starter added to Fresh milk at suitable temp forms curd

* LAB increased → nutritional value of curd → ↑ Vit. B₁₂

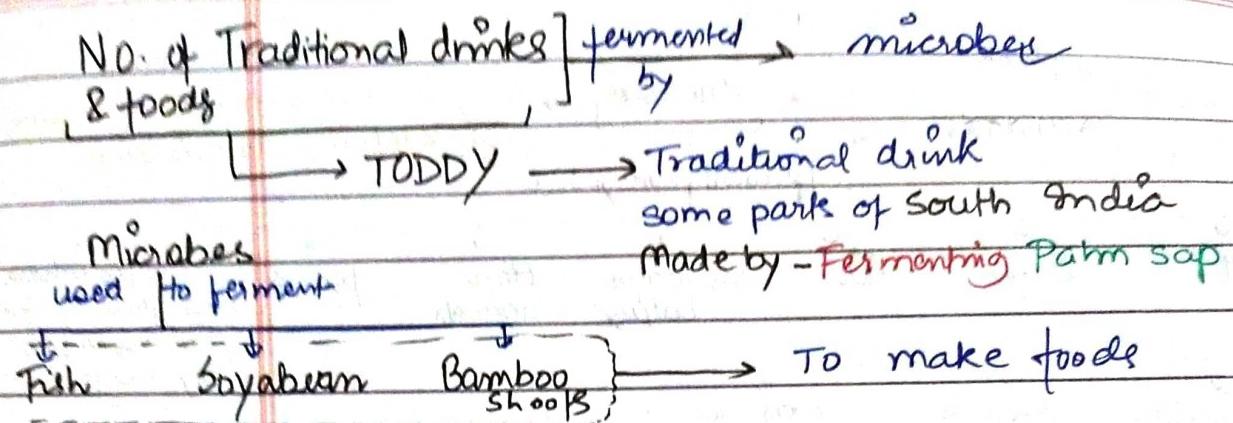
In stomach beneficial role in checking disease causing microbes

Dough used for making Dosa is fermented by bacteria

puffed appearance due to production of CO₂ gas

used for making BREAD Fermented by → BAKER'S YEAST

(Saccharomyces cerevisiae)



CHEESE → One of oldest food items in which microbes were used.

different varieties known by their characteristic taste, texture & flavour } specificity comes from the microbes used

SWISS CHEESE Large holes → due to production of CO₂

Bacterium - Propionibacterium Shermanni ← by

ROQUEFORT CHEESE ripened by growing specific FUNGI on them

Particular flavour gives

MICROBES IN INDUSTRIAL PRODUCTS

Production on Industrial scale → requires growing microbes in very large vessel called FERMENTATORS.

FERMENTED BEVERAGES

YEAST specially used from time immemorial

production of BEVERAGES

Wine Rum Brandy Beer Whisky

Same yeast → *Saccharomyces cerevisiae*

Used, commonly called brewer's Yeast

for fermenting malted cereals

Fruit Juices

ETHANOL → produced

① Type of raw material used for fermentation

diff. types of alcoholic drinks are obtained.

microbes prod. by ANTIBIOTICS

one of the most significant discoveries of 20th century

Anti → 'against' Bio → "life" greek

"against life"

in control of disease causing organism

With reference to human beings → "pro life"

Antibiotic → chemical subs

Produced by some microbes to kill/inhibit growth of other microbes

out
Distillation → Wine
Distillation → Beer

Distillation
of fermented
broth. → Whisky
→ Brandy
→ Rum.

3 CHEMICAL, ENZYMES &
OTHER BIOACTIVE MOLECULES

Organic Alcohols Enzymes acids produced by microorganisms

• Acid Producers

- 1) Citric acid - *Aspergillus Niger* (Fungus)
- 2) Acetic acid - *Acetobacter aceti* (a bacterium)
- 3) Butyric acid - *Clostridium Butylicum* (a bacterium)
- 4) Lactic acid - *Lactobacillus* (a bacterium)

Yeast - *Saccharomyces cerevisiae*
used for production of
Ethanol.

* Microbes are used in prod. of enzymes

• Lipase used for detergent formulations
Removes oily stains from laundry

• Pectinases + Proteases used for clearing bottled juices
(Market bottled juices are dearer than home made)

• Streptokinase → By *Streptococcus* bacterium

modified by
Genetic Engineering

"Clot Buster" → removing clots from B.V. of patient

is who have undergone heart attack leading to myocardial infarction

• Bioactive Molecule → Cyclosporin A → By fungi *Trichoderma Polysporum*

↳ Immunosuppressive agent in organ transplant patients

PENICILLIN (antibiotic) → first antibiotic to be discovered

Chance Discovery

Alexander Fleming working on *Staphylococci* bact.
Observed a mould growing in one of his uncultured cultures around which *Staphylococci* could not grow due to chemical prod. by mould (*Penicillium notatum*)

PENICILLIN

named after mould

used extensively to treat American soldiers wounded in World War II.

Full potential as an antibiotic effectively established much later by
① Ernest Chain ② Howard Florey

Awarded Nobel prize - 1945 for discovery

After penicillin → other antibiotics were also purified from other microbes

Antibiotic helped greatly in improving our capacity to treat deadly disease and

Plague Whooping Cough Diphtheria Leprosy
Kali Khansi Gal ghotu Kusht Rog

→ used to kill millions all over globe

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• Starting \rightarrow produced by Yeast \rightarrow Monascus Purpureus

↓ commercialise Blood cholesterol lowering agents A Page

acts competitively \rightarrow enzyme responsible for synthesis of cholesterol.

MICROBES IN SEWAGE TREATMENT

Large quantities of waste water are generally generated everyday in cities and towns } major component of this waste water \rightarrow Human Excreta.

* Municipal waste water called **SEWAGE** contains

* Sewage can't be disposed off directly into water bodies \rightarrow streams, River

Before disposal treated in (SIPs) \rightarrow Sewage Treatment plants \rightarrow To make sewage less polluting

large amt. of organic matter which \downarrow many microorganisms \downarrow pathogenic which

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Treatment of waste water done by Microbes naturally present in sewage

12 stages

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Primary Treatment

involves

Physical removal of particles

large \downarrow Small \downarrow

through

Filtration Sedimentation

Ist Floating debris

Ind grit

removed soil small pebbles

Primary effluent passed to Large aeration tank

where it is

Growth of useful aerobic bacteria

this allows

constantly agitated

mechanically & air is pumped into it.

FLOCS (masses of bact. + fungal filament)

-tend to form mesh like structures.

Major part of while growing organic matter

these microbes in effluent consume

air

BOD is reduced.

Sewage water treated till

significantly reduces BOD (biochem. oxygen demand) of effluent

BOD \rightarrow Amt. of O₂ that would be consumed if all the organic matter in

1 L is oxidised by bacteria.

BOD or polluting potential

All solids that settle form the - primary sludge

Supernatant \rightarrow effluent taken for

Secondary Treatment

BOD test measuring Rate of uptake of O_2 by micro-organisms
in a sample of water, & thus
BOD - indirect measure of organic matter present in water.

Once BOD of sewage water is reduced significantly.

Pumped back to its aeration tanks A small part of it

The effluent passed to

Settling tanks

where Bacterial flocs are allowed to sediment

Activated sludge

this sediment is called

remaining (major) part pumped to

To serve as inoculum

Large tanks
Anaerobic Sludge Digesters

Other kinds of bacteria grow anaerobically

Bacteria produce during this digestion

in sludge

Bacteria Fungi

digest

H_2S CH_4 CO_2

form

BIOGAS

source of energy

The effluent from Secondary Treatment plants

released into

Natural Water Bodies

Streams Rivers

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- * Till Date \rightarrow no man-made technology has been able to rival the microbial treatment of sewage
- * Quantity of sewage is large \rightarrow No. of sewage treatment plants (due to \uparrow urbanisation)

② Unreated sewage is often discharged directly into rivers leading to their pollution & \uparrow in water borne disease

* Ministry of Environment has initiated Ganga Action plan & Yamuna Action plan

Under these plans To save these major rivers of our country from pollution.
 ↓ proposed
 to build a large no. of sewage treatment plants
 So that only treated sewage is discharged into river

Methanogens produce biogas while degrading plant waste

MICROBES IN PROD. OF BIOGAS

Biogas → mixture of gases
predominantly CH_4

may be used as fuel

Certain Bact. grow anaerobically

prod. large amt. of CH_4

along with CO_2
H₂

Produced by microbial activity

① microbe used

② organic subs. they utilize

depends on

Microbes produce

diff. type of gaseous end products

during

Growth

Metabolism

Type of gas produced

METHANOGENS

one common bacterium

commonly found in

Rumen (a part of stomach)
of cattle

Anaerobic sludge (during sewage treatment)

has a lot of cellulose material
present in food of cattle is present.

these
bad.

Breakdown cellulose
& play imp. role in nutri-
tion.

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Humans — not able to digest cellulose → No cellulase present.

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Excreta of cattle → dung (commonly called) Gobar → rich in bacteria (methanogens)

used for generation of Biogas

Biogas Plant

consists of

① Concrete tank

→ 10-15 ft deep
bio waste collected

②

Floating Cover

→ store of dung
fcds

* Spent slurry removed through

placed over slurry

Keeps on rising
as gas is prod.
due to microbial
activity in tank.

Another outlet

connected to
pipe to supply
biogas to nearby
houses.

may be used
as FERTILIZER

* Cattle dung → more available in Rural areas (large quantity)

cattles here

are used for
variety of purposes

Biogas plants are more [↓] to meet

after built here.

Biogas prod. used for cooking
Lightening

* Technology of Biogas production was developed in INDIA due to efforts of TANISHA SACHAN AIR 1747 Khadi & Village Industries Commission

IARI

Indian Agricultural Research Institute

KVIC

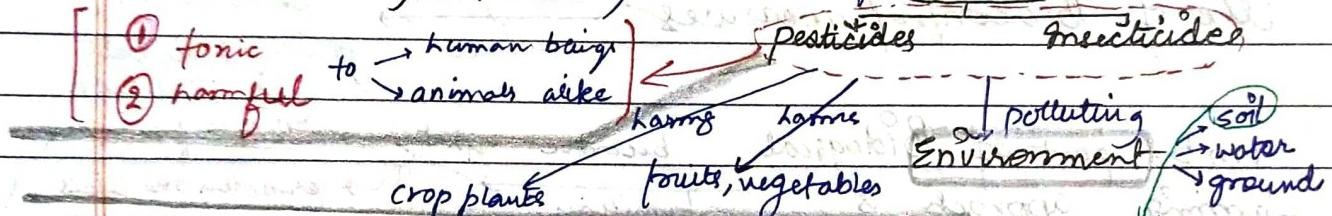
AIR 1747 NCERT THREAD NOTES

Khadi & Village Industries Commission

MICROBES AS BIOCONTROL AGENTS

Biocontrol refers to use of Biological agents for controlling plant diseases Pests

* In modern society these problems tackled by ↑ use of chemicals



Biological Control of Pests Diseases

In Agriculture → there is method that of controlling pests relies on (rather than introducing chemicals) **Natural Predation**

* Key belief of farmer → Biodiversity furthers Health

* More variety a landscape has, more sustainable it is.

Organic farmer works to create a system where insects that are called pests sometimes are not eradicated.

Kept at manageable levels by complex system of checkers but instead

within a living & vibrant ecosystem.

contrary to "conventional" farming practice where chemicals are used to kill both

Not good -

useful → harmful forms indiscriminately

Biocontrol → **Holistic Approach** that seeks to develop understanding of webs of interaction b/w myriad of organisms

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Organic farming holistic view → eradication of creatures that are often described as pests is not possible, but also undesirable

would not be able to survive

Beneficial predators

parasites (insects)

which depend on them for food
hosts

Use of Biocontrol measures → will greatly reduce dependence on toxic chemicals & pesticides

Imp. part of Biological farming approach is to become familiar with various life forms that inhabit field → predators and pests → their life cycle → patterns of feeding → habitats they prefer

this will develop appropriate means of biocontrol.

Ladybirds & Dragonflies control lice of Aphids control lice of mosquitoes

bacteria available as in sachets or dried spores **Bacillus Thuringiensis** control Butterly caterpillars

mixed with water sprayed on vulnerable plants eaten by insect larvae in gut of larvae toxin released & larvae gets killed

Bac. disease will kill the caterpillars, but leave other insects unharmed.

Bcz of development of methods of Genetic engineering in the last decade or so, the scientists have introduced *B. thuringiensis* toxic genes into plants.

Such plants → Resistant to attack by insect pests. (Bt. cotton example)

fungus *Trichoderma*, (free living)

↳ very common in Root ecosystem

effective biocontrol agents of several plant pathogens.

Baculovirus

Genus

are pathogens

Attack insects & other arthropods

Nucleopolyhedrovirus

no-ve impacts on

excellent candidates for

Narrow spectrum insects

cater opifices

①

species specific

(1) Beneficial insects are being conserved to aid in an overall Integrated Pest management (IPM)

(2) OR, when Ecologically sensitive are to be treated

MICROBES AS BIOFERTILISERS

Organic farming

use of Biofertilisers.

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enrich nutrient quality of soil

that

organising

main source

Bacteria

Fungi

Cyanobacteria

* Roots of leguminous plants formed by symbiotic association of Rhizobium

Nitrogen

used by root os

fix atm. nitrogen into organic forms

• Bact that fix atm N₂
free living in soil] Azospirillum
Azotobacter } thus enriching nitrogen content of soil-

• Mycorrhiza → Many members of Genus - *Glomus*
(Symbiosis) (Mutualism) Fungal symbiont → absorbs P from soil to plant

Other benefits

Resistance to root borne pathogens ↓ tolerance to Salinity Drought small ↑ in plant growth → Development.

• Cyanobacteria → autotrophic microbes

Many can fix atm. N₂ ↓ widely distributed in aquatic environment

Anabaena Nostoc Oscillatoria

In Paddy field. → cyanobacteria - imp. biofertilizer.

BG&A adds → Organic matter to soil → ↑ fertility

Currently - In our country → a number of biofertilizers

are available commercially in market

To replenish soil nutrients ←

Farmers use these regularly in their fields ←

Reduce dependence on chemical fertilizers